Chapter 7
Towards the Development of a Game for Computational Thinking: Identifying Students' Needs and Interests

Panagiotis Kosmas
Center for the Advancement of Research and Development in Educational Technology, Cyprus & School of Education, University of Nicosia, Cyprus

Andrea Philippou
Center for the Advancement of Research and Development in Educational Technology, Cyprus

Panagiotis Psomos
University of the Aegean, Greece

ABSTRACT

Computational thinking (CT) is now considered an essential approach for developing critical thinking and 21st-century skills. CT as a teaching methodological approach is more connected to STEM education as it provides clearer conceptual and practical considerations to understand science, computer, and mathematical concepts. Based on the recent literature, educational robotics, applications, and serious games are the means of applying CT in teaching practice. This study examines students' needs, interests, and motivations for using a game in the context of CT. Quantitative analysis from an online questionnaire to 394 students from secondary education in different five countries (Greece, Cyprus, Italy, Poland, United Kingdom) demonstrate the students' game interests and needs that guide us to develop a game for CT's implementation in the classroom. Essential insights, considerations, and implications are providing for the design, development, and use of games for the CT in an educational environment.

DOI: 10.4018/978-1-7998-7443-0.ch007

INTRODUCTION

Nowadays, in the digital society of the 21st century, the exponential onset of computers is forcing a transition in which digital literacy is now a necessary ability to cultivate (Shute, Sun, & Asbell-Clarke, 2017; Angeli & Giannakos, 2020). Most of us use computers regularly and we need to learn how to work with them to get the most out of their computing power (Shute et al., 2017).

It seems that CT is the new literacy. Wing (2006) acknowledged CT as a vital skill cultivated by all literate people attending compulsory education to supplement the other three key competencies: reading, writing, and mathematical skills. Since then, several research studies have been published and many scientific discussions among scholars have been started on how CT can be integrated into the school practice. CT is considered as a thinking process (or otherwise a human thinking ability) that uses analytical and algorithmic methods to formulate, evaluate and solve problems (Bocconi et al, 2016). CT, also, has been advocated by most educational policy makers as a capability that is equally important for all as numeracy and literacy (Bocconi et al, 2016). Not only it is the core for the STEM disciplines and courses (Science, Technology, Engineering and Mathematics), but it is also useful in daily life. The human brain itself is wired to think computationally; therefore, our development and future prospects need to learn how to use its full potential (Henderson, Cortina & Wing, 2007).

In an academic setting, the use of various game tools and educational robotics can be a fun and motivating technique and is recommended to support teaching and learning in the context of CT (Ioannou & Makridou, 2018). Specifically, serious games applications can support teachers' practices providing further understanding and meaningful experiences to students (Anastasiadis, Lampropoulos & Siakas, 2018). As educators continue to unlock their skills, serious and other mobile games, tools or applications are becoming increasingly widespread (Kazimoglu, Kiernan, Bacon, & Mackinnon, 2012). In parallel, students are getting used to gaming in their everyday lives, and technology is even more present around us. Minimizing or eradicating the "digital gap" is vital by promoting more significant involvement in the growing digital environment. Along the same lines, educational robotics is closely related to the CT approach, as it offers to students opportunities to think, develop, construct, communicate, collaborate, and critically reflect on their creations and solutions (Alimisis 2013; Bers, Flannery, Kazakoff, & Sullivan, 2014; Eguchi, 2010).

There are several grey areas in the literature and lots of definitions and explanations, including the definition of CT and mainly how CT can be incorporated into the school curriculum. The use of tools such as robotics posit CT as a very promising area to support learning outcomes at schools (Angeli & Giannakos, 2020). Despite that, different kinds of serious games have been proposed as another way to cultivate students' CT. Based on the existing empirical literature, this chapter aims to provide an important set of considerations regarding the development and the use of robotics and serious games to promote the development of CT in educational contexts. The innovation of this study is the provision of significant conclusions based on secondary education students' perspectives regarding the design and development of a game to be used in the classroom in the context of CT. Educators or researchers could use our findings and conclusions to develop an interesting, meaningful and attractive learning experience applying CT's concepts and approaches.

What follows is first the provision of some theoretical underpinnings, principles, and definitions in CT. After that, the chapter offers an overview of recent empirical studies on the application of games to enhance CT and discusses what the literature demonstrates on the implementation of CT in education. The following section describes the methodology used in this research and presents the most important